placed in Brassolis. In Kirby's Catalogue of Diurnal Lepidoptera and Supplement (1871 and 1877) we find eight genera of Brassolidæ and fifty-four species, while Dr. Stichel now enumerates eleven genera and seventy-five species, in addition to a very considerable number of forms treated for the present as subspecies.

Dr. Stichel describes the species at great length, adding tables of the genera, species, and subspecies. The synonymy of the genera and species is very *fully given, and the* excellent text-illustrations include the neuration of one species of each genus, and also the markings of the wings of a large number of species, both surfaces being usually figured. Descriptions are also given of the eggs, larvæ and pupæ of the insects, as far as known at present, and the range of each species is also indicated. On pp. 3 and 4 we find general information on the habits of the butterflies, and should have liked more detail under the various species; but we presume that there was either no room, or the available information on the subject was too meagre to be worth giving, except in a general manner.   W. F. K.

The Volcanic Origin of Coal and Modern Geological Theories: a Plea for Lessening Demands on Geological Time; and for Further Separating the Life Histories of the Aqueous and Volcanic Formations. By Col. A. T. Fraser (late R.E.). Pp. 21. (London: R. Banks and Sons, 1909.)

THE old Wernerians used to account for volcanic action by the supposed combustion of coal within the earth's crust, but the author of this pamphlet turns the tables upon them by making the volcanoes produce the coal! The way in which this feat is performed is as follows:—first by pointing out that in the sides of the active volcano Gedeh in Java the tuffs are seen to be well stratified, and look, *at a distance*, like old red sandstone; then the mud deposits ejected by the eruption of Tarawera in New Zealand are also stratified. Next, we have somewhat of a leap in the advance of the argument. The Java experience showed, *though coal was absent*, another way in which it (coal) might originate; namely, being rained down in a shower of bitumen alternately with sandstones, shales, &c. In support of this view we are told that a visit to " the quarries of Carrara and Parnassus " show that " marble is a volcanic rock," " ejected, accompanied by high-pressure steam, from a fissure and showered down." We must leave our author with the coal and marble, and not attempt to follow his leading among geological theories, old and new. We fear, judging from books advertised on a fly-leaf at the end of the one before us, that the author has been so much occupied with psychical research, occult powers of Eastern nations and the religions of the world, that he has not found time for even a very little elementary chemistry.

Cassell's " Nature " Copies (Wild Flowers). Aids to Nature Study, Brushwork, and Drawing. In twelve packets. (London: Cassell and Co., Ltd., n.d.) Price 6d. net per packet.

EACH of these packets of drawing copies contains ten examples of pictures of wild flowers executed in colours on stout plate paper. Though the best plan is to have wild flowers drawn from actual specimens, these copies may serve a useful purpose in town schools, where it is very difficult or impossible to procure the plants themselves; in any case they will add variety to the art work, and familiarise children with the beauty of common wild flowers.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

August Meteoric Shower.

I HAVE summarised in a form which may be convenient for comparison some of the results of Perseid observations this year. The differences in some cases are remarkable, and sufficiently prove that to arrive at definite conclusions respecting the character of a shower a large number of materials should be consulted and averaged. Weather conditions are dissimilar, the places of observation are not equally well situated (certain positions in towns are much affected by artificial light), and there are other causes which must introduce discordances. Though comparatively few Perseids were observed at Bristol and Meltham on August 10, they were fairly numerous at Blaina and Antwerp, and on the night of August 12, when a rich display of brilliant meteors was remarked at Bristol, there was no striking exhibition witnessed at several other places.

Results of Perseid Observations, 1909.

	Aug.		h. m. h. m.		h. m.		Meteors	Perseids
C. B. Pennington, Notts.	11	...	9 0–12 0	...	3 0	...	50	
Mrs. H. P. Hawkins, Brockham, Surrey ...	11	...	10 0–13 0	...	3 0	...	80	
Miss Irene Warner, Bristol {	11	...	10 0–11 37	...	1 37	...	60	... 55
	12	...	10 0–10 30	...	0 30	...	9	... 6
John Hicks, Weston-super-Mare ... ... {	11	...	9 30–10 0	...	0 30	...	30	
	12	...	9 30–10 30	...	1 0	...	9	
Mrs. R. M. Brook, Meltham, Huddersfield ...	11	...	10 0–11 30	...	1 30	...	54	
T. K. Jenkins, Blaina ... {	10	...	10 50–12 5	...	1 15	...	30	
	11	...	9 48–12 10	...	2 22	...	78	
	12	...	9 14–10 43	...	1 29	...	12	
C. L. Brook, Meltham ... {	9	...	10 25–12 15	...	1 35	...	15	... 10
	10	...	10 25–12 25	...	1 35	...	23	... 14
W. F. Denning, Bristol... {	8	...	9 45–11 0	...	1 30	...	12	... 6
	9	...	9 45–11 30	...	1 30	...	8	... 4
	10	...	9 15–12 0	...	1 45	...	19	... 12
	11	...	9 5–11 50	...	2 45	...	73	... 67
	12	...	9 0–12 52	...	2 30	...	65	... 55
	13	...	9 5–11 45	...	1 45	...	25	... 11
	14	...	9 0–11 50	...	1 45	...	19	... 7
C. Birkenstock & another, observer, Antwerp ... {	7	...	11 50–13 0	...	1 10	...	3	
	8	...	11 25–13 0	...	1 35	...	19	
	9	...	11 0–12 20	...	1 20	...	15	
	10	...	10 15–14 0	...	3 15	...	113	
	11	...	10 30–14 0	...	3 30	...	129	
	12	...	10 30–14 0	...	3 30	...	96	
Col. E. E. Markwick, Boscombe	11	...	10 7–11 40	...	1 33	...	40	... 38
Ellison Hawks, Leeds ...	11	...	10 30–dawn ...	—		...	175	
J. L. Haughton and another, Dublin ... ... {	10	...	10 0–11 0	...	1 0	...	20	... 17
	11	...	9 0–12 0	...	3 0	...	57	... 48
	12	...	8 30–10 30	...	2 0	...	50	... 35
	13	...	9 15–10 15	...	1 0	...	19	... 15

Apparently few determinations of the radiant have been made, but so many values have been found for this at previous returns that further estimates are not much needed. Photographic impressions of the trails would be of essential value as giving, not only a very exact position for the radiant, but as indicating its character and the extent of its diffusion.   W. F. DENNING.

The Ringing of House-bells without Apparent Cause.

UNTIL I read the two letters in NATURE of July 22 and August 12 I had no idea that the ringing of house-bells without apparent cause was so fascinating a subject, as my own experience of it has been rather prosaic. One of my bells occasionally rings when no one is in the room, but it is entirely due to bad workmanship. The strength of the spring which draws the wire back after it has been pulled is only about equal to the friction of the wires, and the result is that, though it generally draws the wire back immediately after it has been pulled, yet it sometimes fails to do so at the time; but after some time, it may be hours, owing to some change in the conditions, it succeeds in drawing back the wire, when the bell again rings when no one is touching it. The bell thus rings once when it is pulled, and a second time when the spring succeeds in drawing back the wire.

The electrical explanation of any mysterious ring-

ings seems hopeless in any conditions, save possibly in a thunderstorm, when we remember that all the bells and wires are in good electric contact with each other, and in more or less indifferent contact at many places with pipes, walls, &c. Further, only the bell at the end of a row could be rung by electrical attraction to the opposite wall, because the bells swing parallel to the wall on which they are fixed, and considerable force is required to make them move in a direction at right angles to their free swing.

In the case referred to by Mr. C. L. Tweedale, it might have been worth while to see if the wire attached to the lively bell he mentions did not come in contact with any other wires at any part of its length. What makes me suggest this is that in one of my rooms I can tell when the front-door bell is rung by a sympathetic movement of the bell-pull in the room, due to the wires rubbing against each other at some part and the wire to the door bell pulling the wire to the room.

When one considers the class of workmanship put into bell-hanging, one need not be surprised at the vagaries of the bells. Like plumber work, it is mostly out of sight, and as the work has often to be done in very imperfect light and under cramped conditions, anything that will work is considered good enough.　　　John Aitken.

Ardenlea, Falkirk, August 21.

FLYING ANIMALS AND FLYING MACHINES.

UNTIL quite recently human flight was considered by the mass of mankind as so impracticable that " I can no more do that than fly " was a phrase used to denote something not to be accomplished. It is no wonder, then, that the fact that several people (probably some dozens at the present moment) have actually flown should appeal to the popular imagination, and the appeal is especially strong in such a case as M. Blériot's flight over the English Channel, although there is nothing really more formidable in a flight over water than over land. It may be of some interest to show briefly how it is that what was formerly looked on as a typical impossibility has now become a matter of everyday occurrence.

It will be a help to take first the case of such animals as have wings, and to see why it is that no creature the height of which approaches even one-quarter that of a man has been able to fly either in present or former times. In order that the wings may support the body, their movement must generate a downward current of air of which the momentum per unit of time is equivalent to the downward momentum which the body and wings would acquire in the same time under the influence of gravity. This does not necessarily involve a large expenditure of work. For instance, when a weight is attached to a parachute and is dropped from a height the speed of descent soon becomes constant, and the work done in the air by the parachute is then just equal to the product of the weight into the distance fallen. The resistance of the parachute is proportional to its area, and the speed of descent can be made as small as we please if the area is made large enough. The work, therefore, expended in a given time, that is, the power delivered to the air, is diminished in the same proportion.

Suppose now that instead of an inanimate weight an animal is suspended from the parachute by a long rope ladder. When the speed of descent is slow enough, the animal will have no difficulty in climbing the ladder at such a rate that the centre of gravity of the " system " may remain stationary in the air, and this by an expenditure of work which can be diminished indefinitely by increasing the area of the parachute.

This case is analogous to the hovering of a bird in

the air without horizontal velocity during the down-stroke of the wings, and as no means are here provided for restoring the wing to its primitive position the time of support is limited. The illustration suffices, however, to show that the work required in order to maintain a stationary position in the air by means of wings is equal to the work required to raise the total weight involved at the same rate as that at which it would fall were no work to be expended.

Of the total weight supported, namely, the animal and the parachute, the animal only is a source of power. Thus, while in " dynamically similar " combinations the total weight varies as the cube of the linear dimensions, the supporting area varies as the square, and the living power available varies, not as the total weight, but as the total weight less the weight of the supporting wing. It will be readily seen that if the animal can only deliver a certain amount of power per unit weight of body these conditions lead to an absolute limit to the weight of an animal which can sustain itself stationary in the air. For, suppose the total weight is $w = w_a + w_s$ (the weights, namely, of the animal and the parachute of area s), w_s must vary as $s^{\frac{3}{2}}$, and if the downward velocity is to be constant s must be proportional to w. From this it can be shown that the greatest weight an animal (incapable of climbing faster than some given speed) can have is $2b^3/3c^2$, where $b = w'/s'$ and $c = w_s'/s'^{\frac{3}{2}}$, w_s' and s' being known values of wing weight and wing area fulfilling the condition of falling with the required velocity when the total weight is w'. If we take $w_s' = w'/n$, the expression $2b^3/3c^2$ becomes $\frac{2}{3}w'n^2$.

As an example, suppose that 30 feet per minute is the limiting velocity at which an animal can continue to climb, and that the area of the parachute which will drop at the appropriate speed when the total weight of parachute and load is 1 lb. is 100 square feet, and also that the weight of the parachute alone is $\frac{1}{4}$ lb., then it appears that no animal could maintain itself stationary in the air by means of a parachute the weight of which exceeded $\frac{2}{3}(4)^2$ (or about $10\frac{1}{2}$ lb.), and the area required for this weight would be more than 1600 square feet. Thus, if no more favourable way of supporting a weight was available than the down stroke of a wing in still air, flight would be impossible for all except the very smallest animals.

As is well known, however, the vertical reaction on a slightly inclined plane moving rapidly in a horizontal direction enormously exceeds that which it would experience in dropping through still air, and although the proportionalities between the weights and the supporting area still remain, viz. $s \propto w$ and $w_s \propto s^{\frac{3}{2}}$, the actual weight which can be supported by a given area increases indefinitely as the horizontal speed increases.

If there were no such thing as air friction, the work expended in supporting a given load might also be reduced indefinitely, for the resistance to the horizontal motion (which, when the inclination of the plane is small, may be regarded as the horizontal component of the normal force) could be diminished indefinitely by decreasing the inclination.

Air friction, however, fixes a limit beyond which the inclination of the plane to the direction of motion cannot be advantageously reduced. Experiments have shown that this inclination is about 5°, and that then the ratio of the supporting force to the resistance lies between 5 and 7 (depending partly on the shape of the plane). A knowledge of the best angle of inclination and the ratio of the resistance to the force on the plane at right angles to its path afford means of determining the possible efficiency (see " Experiments on